



Tropical microalgae isolated on Reunion island (France, Indian ocean) as sources of antifouling molecules: the BIOPAINTROP project

Alexis Bazire, Yves Blache, Laurent Blériot, Christine Bressy, Jean Briand, Dalyal Copin, Gérald Culioli, Maxime Delbury, Laurent Dufossé, Fabienne Fay, et al.

► To cite this version:

Alexis Bazire, Yves Blache, Laurent Blériot, Christine Bressy, Jean Briand, et al.. Tropical microalgae isolated on Reunion island (France, Indian ocean) as sources of antifouling molecules: the BIOPAINTROP project. 18th International Congress on Marine Corrosion and Fouling, Jun 2016, Toulon, France. 2016. hal-01391798

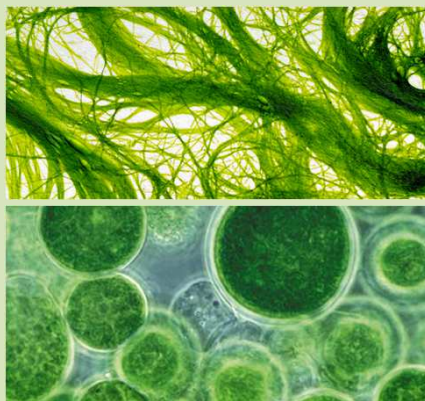
HAL Id: hal-01391798

<https://hal.science/hal-01391798>

Submitted on 3 Nov 2016

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Tropical microalgae isolated on Reunion island (France, Indian ocean) as sources of antifouling molecules: the BIOPAINTROP project

Alexis BAZIRE³, Yves BLACHE², Laurent BLÉRIOT⁵, Christine BRESSY², Jean-François BRIAND², Dalyal COPIN³, Gérald CULIOLI², Maxime DELBURY⁶, Laurent DUFOSSÉ⁴, Fabienne FAY³, Isabelle GRONDIN⁴, Isabelle LINOSSIER³, Ludovic MANGRIE⁵, Karine REHEL³, Pierre SAULEAU³, Thierry TAYE⁶, Alina TUNIN-LEY^{1,*}, Jean TURQUET^{1,*}, Claudia ZEA OBANDO³ and Mayalen ZUBIA¹

¹ HYDRÔ Réunion, Sainte-Clotilde, Île de La Réunion, France.

² MAPIEM, Université de Toulon, France.

³ LBCM, Université de Bretagne Sud, Lorient, France.

⁴ LCSNSA, Université de La Réunion, Indian ocean, France.

⁵ BIOALGOSTRAL, Sainte-Clotilde, Île de La Réunion, France.

⁶ NAUTIX, Guidel, Bretagne, France.

*Corresponding author E-mail. jean.turquet@hydroreunion.re ; Presenting author

Biofouling is associated to colonization of artificial submerged structures by aquatic organisms. This process induces adverse effects such as loss of hydrodynamism, weight increase of equipments... Numerous toxic compounds (copper, arsenic) have been used during decades to avoid biofouling of ships, until organostatic substances were developed. According to their toxicity for marine environment and fauna, due to their non-specificity and non-biodegradability, EU has banned them since 2008. For this reason, a new strategy, focusing on environmental friendly molecules is requested aiming to provide coatings that release progressively active natural compounds, non-toxic for environment. In tropical marine environment, deterrent molecules are recognized as one of the most efficient way for protection against predators or competition with other surfaces organisms (e.g corals, microalgae). Such active compounds are considered quite « infinite » (20,000 have been described to date), so of them for their antifouling activity. As a significant component of marine organisms, microalgae are a promising source of active natural substances, with biotechnological potential value. Growing microalgae is a worldwide project for various purposes actually e.g. biofuel. BIOPAINTROP project aims to develop antifouling coatings with active biomolecules originating tropical marine resources (microalgae) from Reunion Island. 2 main objectives have been designated: (i) identification of active molecules from tropical microalgae and (ii) incorporation of these compounds in adequate coatings to confirm the efficiency of these products in both temperate and tropical marine environment. To reach the targeted results, a pluridisciplinary group has been set up with 6 French teams with complementary expertises: (i) HYDRÔ based on Reunion island and specialized in tropical marine microalgae, (ii) 3 University laboratories: LCSNSA (Reunion) specialized in natural products valorisation, LBCM (Bretagne), specialized in marine biotechnologies; MAPIEM (Toulon) specialized in polymer materials engineering and marine biocompounds, (iii) Private partners: NAUTIX producing environmental friendly paints, expert in processing ecological and antifouling coatings; BIOALGOSTRAL a start-up from Reunion specialized in production/valorisation of microalgae biomass.

BIOPAINTROP project funded by the French National Research Agency (ANR) – 2012/2017.



PT S11-12

Tropical microalgae isolated on Reunion island (France, Indian Ocean) as sources of antifouling molecules: the BIOPAINTROP project

Alexis BAZIRE³, Yves BLACHE², Laurent BLÉRIOT⁵, Christine BRESSY², Jean-François BRIAND², Dalyal COPIN³, Gérald CULIOLI², Maxime DELBURY⁶, Laurent DUFOSSÉ⁴, Fabienne FAY³, Isabelle GRONDIN⁴, Isabelle LINOSSIER³, Ludovic MANGRIE⁵, Karine REHEL³, Pierre SAULEAU³, Thierry TAYE⁶, Alina TUNIN-LEY¹, Jean TURQUET^{1,*}, Claudia ZEA OBANDO³ and Mayalen ZUBIA¹

¹ HYDRÔ Réunion, Sainte-Clotilde, Île de La Réunion, France.

² MAPIEM, Université de Toulon, France.

³ LBCM, Université de Bretagne Sud, Lorient, France.

⁴ LCSNSA, Université de La Réunion, Indian ocean, France.

⁵ BIOALGOSTRAL, Sainte-Clotilde, Île de La Réunion, France.

⁶ NAUTIX, Guidel, Bretagne, France.

* jean.turquet@hydoreunion.re

Biofouling is associated to colonization of artificial submerged structures by aquatic organisms. This process induces adverse effects such as loss of hydrodynamism, weight increase of equipments... Numerous toxic compounds (copper, arsenic) have been used during decades to avoid biofouling of ships, until organostatic substances were developed. According to their toxicity for marine environment and fauna, due to their non-specificity and non-biodegradability, EU has banned them since 2008. For this reason, a new strategy, focusing on environmental friendly molecules is requested aiming to provide coatings that release progressively active natural compounds, non-toxic for environment. In tropical marine environment, deterrent molecules are recognized as one of the most efficient way for protection against predators or competition with other surfaces organisms (e.g corals, microalgae). Such active compounds are considered quite « infinite » (20,000 have been described to date), so of them for their antifouling activity. As a significant component of marine organisms, microalgae are a promising source of active natural substances, with biotechnological potential value. Growing microalgae is a worldwide project for various purposes actually e.g. biofuel. BIOPAINTROP project aims to develop antifouling coatings with active biomolecules originating tropical marine resources (microalgae) from Reunion Island. 2 main objectives have been designated: (i) identification of active molecules from tropical microalgae and (ii) incorporation of these compounds in adequate coatings to confirm the efficiency of these products in both temperate and tropical marine environment. To reach the targeted results, a pluridisciplinary group has been set up with 6 French teams with complementary expertises: (i) HYDRÔ based on Reunion island and specialized in tropical marine microalgae, (ii) 3 University laboratories: LCSNSA (Reunion) specialized in natural products valorisation, LBCM (Bretagne), specialized in marine biotechnologies; MAPIEM (Toulon) specialized in polymer materials engineering and marine biocompounds, (iii) Private partners: NAUTIX producing environmental friendly paints, expert in processing ecological and antifouling coatings; BIOALGOSTRAL a start-up from Reunion specialized in production/valorisation of microalgae biomass.

Acknowledgments: BIOPAINTROP project funded by the French National Research Agency (ANR) – 2012/2017.

The 18th International Congress on Marine Corrosion and Fouling – ICMCF 2016

*University of Toulon
19-24 June 2016 - Toulon - France*

ORGANIZED ON BEHALF OF
**COMITE INTERNATIONAL PERMANENT POUR LA RECHERCHE SUR
LA PRESERVATION DES MATERIAUX EN MILIEU MARIN (COIPM)**

The COIPM Committee consists of:

Chair:	Tony CLARE	Newcastle University, UK
Vice Chair:	vacant	
Treasurer:	Claire HELLIO	Université de Bretagne Occidentale, France
Secretary:	Maureen CALLOW	University of Birmingham, UK

Committee Members:

Christine BRESSY	Université de Toulon, France
Sergey DOBRETsov	Sultan Qaboos University' oman
Steve McELVANY	Office of Naval Research, USA
Kevin REYNOLDS	International Paint, Ltd, UK
Axel ROSENHAHN	University of Bochum, Germany
Emily RALSTON	Florida Institute of Technology, USA
Kiyoshi SHIBATA	Chiba Institute of Technology, Japan
Dominique THIERRY	Institut de la Corrosion, Brest, France
Serena TEO	National University of Singapore, Singapore

Student Committee:

Marlène LEJARS	Université de Toulon, France
Kody LIEBERMAN	Florida Institute of Technology, USA

Organising & Scientific Committee:

Laboratoire MAPIEM, Université de Toulon (Toulon, France)

Christine BRESSY, *Chair*

Emmanuel ARAGON	Anne DELARUE
Lénaïk BELEC	Marlène LEJARS
Yves BLACHE	André MARGAILLAN
Jean-François BRIAND	Maëlle MOLMERET
Hugues BRISSET	Annick ORTALO-MAGNÉ
Gérald CULIOLI	François-Xavier PERRIN

Pôle Mer Méditerranée (Toulon, France)

Christophe AVELLAN

Unité Recherches et Développements Technologiques, IFREMER (Brest, France)

Chantal COMPÈRE

DCNS Research / Centre Français de l'Anticorrosion (CEFRACOR)

Anne-Marie GROLLEAU

Laboratoire LEMAR, Université de Bretagne Occidentale (Brest, France)

Claire HELLIO

Institut de la Corrosion (Brest, France)

Dominique THIERRY

Sponsors:

LONZA

INTERNATIONAL

HEMPEL

DCNS

NORDOX

SELEKTOPE

JOTUN

SPIESS-URANIA

JANSSEN PMP

BOERO Yacht coatings

IMAREST : Institute of Marine Engineering, Sciences and Technology

Université de Toulon- axe MEDD

American Chemet Corporation

Financial support:

TPM (Communauté d'Agglomération Toulon Provence Méditerranée)

Région PACA (Provence Alpes Côte d'Azur)

Société Chimique de France

Financial support for travel provided by grants from:

The Office of Naval Research

The office of Naval Research Global

Financial support for best oral & poster prizes:

Biofouling

The European Society for Marine Biotechnology

Journal for Marine Science and Engineering

Biointerphases

Exhibitors:

EUROCORR 2016

Byefouling & SeaFRONT

TECAN

TABLE OF CONTENTS

MONDAY June 20, 2016

Plenary- 1	Fouling in times of global change Martin WAHL	1
-------------------	--------------------------------------------------	---

Biofilms & Microbial fouling

Keynote 1A	Understanding the microbiome of the seaweed holobiont Peter STEINBERG	2
Oral 1A	Metagenomic analyses of ship hull biofouling communities Gary J. VORA	3
Oral 2A	Responses of marine microbial biofilm communities to contrasted antifouling coatings in two French Mediterranean sites Thomas POLLET	4
Oral 3A	Biofilm community structure and associated drag penalties on groomed ship hull coatings Kelly HUNSUCKER	5
Oral 4A	Bubbles vs biofilms: a new method for biofilm removal Maria SALTA	6

Cathodic protection in marine environment

Keynote 1B	Cathodic protection and marine organisms: what are the interactions? Anne-Marie GROLLEAU	7
Oral 1B	Harbour of Calais – Cathodic protection monitoring of marines structures Jérôme CROUZILLAC	8
Oral 2B	Compositional, environmental and accelerated testing considerations for the development of new cathodic delamination-resistant coatings for marine hardware Thomas RAMOTOWSKI	9
Oral 3B	Ensure effectiveness of marine applications of cathodic protection by using standardization and certification of competence Marcel ROCHE	10
Oral 4B	Oil and gas subsea equipment - CP challenges in Australia Paul GEORGESON	11

Oral 5A	Regulation of the epibiotic bacterial community by the surface metabolome of the brown alga <i>Taonia atomaria</i> Jean-François BRIAND	12
---------	--------------------------------------------------------------------------------------------------------------------------------------------	----

Biofilms & Microbial fouling

Oral 6A	Fluctuating defence with fluctuating time: temporal variation in the antifouling defence of the brown alga <i>Fucus vesiculosus</i> Mahasweta SAHA	13
Oral 8A	Biofilm ecology of antifouling surfaces in tropical marine environments Siti Zarina Zainul RAHIM	15
Oral 9A	Structure of bacterial and diatoms communities on artificial substrata Sergey DOBRETsov	16

Novel methods to evaluate antifouling efficacy and detect biofouling

Keynote 2B	Metabolomic and genomic imaging of marine biofilms as tools for the study and control of marine biofouling Iwona BEECH	17
Oral 5B	3D scanning to capture configuration and arrangement of fouling roughness Scott STORMS	18
Oral 6B	Rapid performance testing of commercially available hull coatings for navy ships Job KLIJNSTRA	19
Oral 7B	LimnoMar's RotoMarin® - a new opportunity for dynamic field testing Bernd DAEHNE	20
Oral 8B	How clean is this surface? Rapid and quantitative methods to assess biofouling R. Shane ADDLEMAN	21

Advances in fouling release technologies

Keynote 2A	The future of fouling release: performance, practicality and new opportunities Kevin REYNOLDS	22
Oral 10A	Antifouling properties of surface-active borate glasses Kenan FEARS	23
Oral 11A	Amphiphilic copolymers for fouling-release coatings Albert CAMÓS-NOGUER	24
Oral 12A	Tough and durable amphiphilic fouling-release coatings Dean WEBSTER	25

Oral 13A	Preventing bacterial adherence utilising reorienting foul-release coatings Stephen KENNY	26
Oral 14A	FOULPROTECT: development of new coating concepts for achieving a long-lasting protection against marine fouling and biocorrosion Thorsten FELDER	27

Novel methods to evaluate antifouling efficacy and detect biofouling

Oral 9B	Probing diatom adhesion by microfluidics Kim Alexander NOLTE	28
Oral 10B	Screen-printed 96 well-microplates for screening electroactive coatings Hugues BRISSET	29
Oral 11B	Short- and long-term efficacy mesocosm tests: a novel approach Eldad GUTNER-HOCH	30
Oral 12B	An evaluation method of antifouling efficacy in the laboratory using <i>Mytilus galloprovincialis</i> with flow-through systems Ryuji KOJIMA	31
Oral 13B	Laboratory disc rotors for measuring drag and observing the release of attached organisms from fouling release coatings Simon DENNINGTON	32
Oral 14B	Development of experimental hydrodynamic facilities to evaluate the “long-term” performance of marine coatings Irma YEGINBAYEVA	33

TUESDAY June 21, 2016

Plenary- 2	Ambiguous surfaces: Antifouling and fouling release coatings based on self-assembly Christopher K. OBER	34
-------------------	------------------------------------------------------------------------------------------------------------	----

Biocidal antifouling technologies

Keynote 3A	Inhibition of marine biofouling by self-renewal surface consisting of biodegradable polymers Guangzhao ZHANG	35
Oral 15A	Development of new hybrid antifouling coatings ecofriendly Fabrice AZEMAR	36
Oral 16A	Degradable silyl acrylate copolymer: a novel design for self-polishing antifouling coatings Chunfeng MA	37

Oral 17A	Antifouling coatings containing modified nanoparticles with dual antimicrobial effect Marios MICHAILIDIS	38
Oral 18A	Chitosan-ZnO nanocomposite coatings for the prevention of marine biofouling Laili AL-NAAMANI	39
Oral 19A	The efficacy of grooming on antifouling coatings Emily RALSTON	40
Oral 20A	Anti-fouling paint based on gel encapsulated biocide technology for large vessels and ships Eva WALLSTRÖM	41

Microbiologically induced corrosion – Biocorrosion

Keynote 3B	Effect of nutrient pollution on long-term microbiologically influenced corrosion of steel and cast iron infrastructure Robert MELCHERS	42
Oral 15B	Formation mechanisms for iron-rich accretions from World War II shipwrecks in the Gulf of Mexico Brenda LITTLE	43
Oral 16B	<i>S. loihica</i> PV-4: Model organism to study biocorrosion and antifouling coating materials Monica EPIFANIO	44
Oral 17B	Electrochemical study of epoxy coated mild steel in different aqueous environment Umadevi Vadamadurai RATHINAVELU	45
Oral 18B	Potential ennoblement of stainless steel in seawater: influence of dissolved oxygen content and pressure Charles LEBALLEUR	46
Oral 19B	SRB induced accelerated corrosion attack of high strength steel under - 0.85V vs SCE cathodic polarization potential Jizhou DUAN	47
Oral 20B	Local mooring chain corrosion- microbial analysis of <i>in-situ</i> samples Nanni NOËL	48

Macrofouling

Keynote 4A	Progress in the study of adhesion by marine invertebrate larvae Nick ALDRED	49
Oral 21A	Stereoscopic tracking reveals responses of barnacle larvae to surface cues Axel ROSENHAHN	50
Oral 22A	Developing a sensory architecture for response of larval barnacles <i>Amphibalanus amphitrite</i> to surface properties Eric HOLM	51

Oral 23A	Colorful side of fouling: environmental benefit for coral reefs and beyond- Yehuda BENAYAHU	52
Oral 24A	Importance of roughness for marine fouling- laboratory and field tests of algae and barnacles Lena GRANHAG	53
Oral 25A	Using environmental data to describe trends in fouling recruitment: an eastern Florida example Kody LIEBERMAN	54
Oral 26A	Cement proteomics: shared traits and conserved chemistries in barnacle cement proteins from <i>Balanus amphitrite</i> Christopher SO	55
Oral 27A	Spatial - biochemical organization of barnacle adhesive plaques following initial reattachment Daniel BARLOW	56
Oral 28A	Crack propagation in barnacle interfaces Kathryn WAHL	57

Regulation of AF/Corrosion products & Environmental issues

Keynote 4B	Environmental issues associated with antifouling waste Andrew TURNER	58
Oral 21B	Risk assessment – regional assessments of copper based antifouling paints Kevin LONG	59
Oral 22B	Efficiency and toxicity of antifouling sealer coats João FERREIRA	60
Oral 23B	<i>In situ</i> studies of antifouling paint toxicity on snails Maria BIGHIU	61
Oral 24B	Evidencing the impact of trace metals release from antifouling paints into coastal Mediterranean environments: insights from Krka Estuary (Croatia) and Toulon Bay (France) Cédric GARNIER	62
Oral 25B	Antifouling innovation in a highly regulated environment: thinking outside the box or ticking boxes? The here and now of EU-BPR Linda JONES	63
Oral 26B	Organotin speciation in historic layers of antifouling paint on leisure boat hulls Maria LAGERSTRÖM	64
Oral 27B	New analytical method to measure release rates of copper under field conditions Erik YTREBERG	65
Oral 28B	A novel XRF application for boat inspection - Fast quantification of tin, copper and zinc Britta EKLUND	66

WEDNESDAY June 22, 2016

- Plenary- 3** Innovative methods to approach microbial corrosion and its prevention 67
Pierangela CRISTIANI

Microbiologically induced corrosion – Biocorrosion

- | | | |
|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| Oral 29A | <i>Halomonas titanicae</i> - How corrosive is that microorganism actually compared to a sulfate reducer such as <i>Desulfovibrio indonesiensis</i> ?
Nanni NOËL | 68 |
| Oral 30A | Influence of environmental seasonality on biocorrosion development over stainless steel AISI316L exposed to natural seawater
Leslie DAILLE | 69 |
| Oral 31A | Marine electroactive biofilms responsible for stainless steel ennoblement - An EcoGenomic approach
Florian TRIGODET | 70 |
| Oral 32A | Microbial influenced corrosion in mixed microbial consortia from equatorial environment
Enrico MARSILI | 71 |
| Oral 33A | Effect of <i>Bacillus</i> sp. biofilm on corrosion of Al thermal sprayed coatings and cathodic protection of SS 316L in marine environment
Leila ABDOLI | 72 |
| Oral 34A | Self-assembled and dip-coated nanolayers as anti-biofouling protective coatings on copper, copper alloys, and stainless steel
Lorand ROMÁNSZKI | 73 |

Climate changes, invasive species and biofouling

- | | | |
|------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| Keynote 5B | Increased defenses against fouling in non-native populations of an invasive seaweed
Florian WEINBERGER | 74 |
| Oral 29B | LC-MS based metabolomics in integrated field and laboratory approaches towards unravelling the impact of metal contamination on marine biofilms
Laurie FAVRE | 75 |
| Oral 30B | The transport of marine biofilms through freshwater via the Okeechobee Waterway ('Florida's Panama Canal') and their effects on subsequent macrofouling recruitment
L. Holly SWEAT | 76 |

Oral 31B	Barnacle adhesion and biomineralization in a changing ocean: assessing the effects of seawater salinity and pH Gary H. DICKINSON	77
Oral 32B	New life, new challenge: antifouling defence patterns of native and non-native populations of an invasive seaweed suggest a potential for rapid defence adaptation to new microbial foulers Mahasweta SAHA	78
Oral 33B	Project Helm: big data and multivariate modeling for fouling risk mitigation Richard RAMSDEN	79

THURSDAY June 23, 2016

Plenary- 4	Bio-inspired anti-fouling compounds Peter PROKSCH	80
-------------------	------------------------------------------------------	----

Impact & Applications of marine fouling and corrosion research and technologies

Keynote 5A	Global ocean industry collaboration to address the economic and environmental impacts of marine fouling Christine VALENTIN	81
Oral 35A	Antifouling coatings for marine energy applications: criteria, challenges, and analysis George BONHEYO	82
Oral 36A	Corrosion and biofouling of offshore wind monopile foundations Claire CANNING	83
Oral 37A	13 years experience with fouling release coating on a RNLN frigate Job KLIJNSTRA	84
Oral 38A	Effects of biofouling on performance, as measured during a series of ship trials conducted on the high-speed, jet-powered catamaran, USNS Choctaw County (EPF 2) Dominic CUSANELLI	85
Oral 39A	Propeller roughness condition and its impact on vessel fuel efficiency – A case study on US Navy CG- and DDG-class vessels Elizabeth HASLBECK	86
Oral 40A	Influence of hydrodynamic stress on frictional drag and fouling community structure J. Travis HUNSUCKER	87

New antifouling responsive and textured surfaces

Keynote 6B	Bio-inspired marine antifouling strategies for improved deployment performance Fiona REGAN	88
Oral 34B	Electroactive polymers based on ferrocenyl methacrylates for antifouling applications Marlène LEJARS	89
Oral 35B	TRAP-Triggered antifouling protection Mattias BERGLIN	90
Oral 36B	Polymers supported electroactive species for antifouling applications Frédéric GOHIER	91
Oral 37B	Patterned photo-crosslinking of thermo-responsive hydrogels for dynamic surface structures Sander KOMMEREN	92
Oral 38B	Progress in Phillips Runwell UV-based antifouling technology Bart SALTERS	93
Oral 39B	Development of an inexpensive nontoxic biomimetic composite antifouling coating R. Shane ADDLEMAN	94

Impact & Applications of marine fouling and corrosion research and technologies

Oral 41A	Design of pressure drop section to measure frictional drag of fouling control surfaces Serkan TURKMEN	95
Oral 42A	Validation of computational model for predicting frictional resistance by using typical profile data for fouled surfaces Bercelay NIEBLES ATENCIO	96
Oral 43A	A new approach to predicting the impact of fouling control coatings on ship efficiency Barry KIDD	97
Oral 44A	A practical approach for predicting fouling impact on ship resistance Yigit Kemal DEMIREL	98

Adhesion, signaling & Biofilm formation

Keynote 6A	Quorum sensing, biofilms and biofouling: a complex relationship Ana OTERO	99
---------------	------------------------------------------------------------------------------	----

Oral 45A	Inhibition of violacein production in marine bacteria <i>Pseudoalteromonas ulvae</i> TC14 by quorum sensing inhibitors Armande Mireille AYE	100
Oral 46A	Adsorption of alginate and albumin affects colonization behaviors of bacteria and diatoms in artificial seawater Xiaoyan HE	101
Oral 47A	A sticky situation: understanding the mechanism of diatom adhesion Nicole POULSEN	102
Oral 48A	Analysis of marine adhesives of diatoms with X-Ray nanoprobe fluorescence Susan STUHR	103
Oral 49A	The effect of surface chemistry on diatom movement and aggregation John FINLAY	104
Oral 50A	Evaluation of quorum quenching and anti-biofilm activity in temperature resistant marine bacteria isolated from marine macroalgae Andreas MURAS	105

Novel environmentally friendly antifoulants

Keynote 7B	Evaluation of novel natural and synthetic antifoulants derived from Arctic terrestrial and marine sources Johan SVENSON	106
Oral 40B	From marine natural products (MNPs) to synthetic leads: a new wave of green antifouling solutions? Sofyane ANDJOUH	107
Oral 41B	Camptothecin as an antifouling compound: laboratory tests and field applications Danqing FENG	108
Oral 42B	A new material with low surface energy yielded by reaction of peptide and stainless steel Pan CAO	109
Oral 43B	Impact of a hemibastadin derivative on microfouling settlement Tiffany LE NORCY	110
Oral 44B	Progress in antifouling compounds from marine-derived fungi Shu-Hua QI	111
Oral 45B	Strategic advantages of functionalized POSS derivatives applied to anti-fouling concepts Monika PILZ	112
Oral 46B	Photocatalytic zinc oxide nanocoatings: a green alternative to biocidal antifouling coatings Priyanka SATHE	113

Oral 47B	Antifouling strategy compounds from Red Sea organisms Julie PETITBOIS	114
Oral 48B	Low voltage UV-light emitting miniature LEDs for marine biofouling control: Laboratory and field testing Richard PIOLA	115
Oral 49B	Bursting the iodine vapor bubble: iodine infused aeration for biofouling prevention Natasha C. DICKENSON	116

FRIDAY June 24, 2016

Plenary- 5	Assessing the ship hull fouling penalty – Current knowledge & Outstanding questions Michael Schultz	117
-------------------	--------------------------------------------------------------------------------------------------------	-----

Biosecurity, risk management & Prediction in marine protection

Keynote 7A	The importance of adopting pragmatic vessel biofouling management measures for mitigating the dispersal of aquatic invasive species – An Australian perspective Ashley COUTTS	118
Oral 51A	Minimising marine biosecurity risks of vessels' biofouling in Australia Sonia GORGULA	119
Oral 52A	Biofouling management: Flash info de Nouvelle-Zélande! Eugène GEORGIADIS	120
Oral 53A	Ship biofouling management to minimise species translocation: what works best? John A. LEWIS	121
Oral 54A	Testing for effective prevention and removal of biofouling from ships – Lessons learnt from testing of ballast water management and the fouling removal chain Cato C. TEN HALLERS-TJABBES	122
Oral 55A	A mathematical model to predict wild life population affected by chemicals released from AF/AC paint Kiyoshi SHIBATA	123
Oral 56A	How conservative is the regulatory human health risk assessment? Comparisons between calculated and analytical data using Selektope® as an example Lena LINDBLAD	124

Marine corrosion: Materials & Coatings		
----------------------------------------	--	--

Keynote 8B	Active protective multi-functional coatings on basis of "smart" nanocontainers Mikhail L. ZHELUDKEVICH	125
Oral 50B	Corrosion study of copper-based antifouling coatings on 5083 aluminum Geoffrey SWAIN	126
Oral 51B	A comparison between corrosion protection properties of polyaniline nanofibers and polyaniline nanotubes prepared via self-organization François-Xavier PERRIN	127
Oral 52B	Implementation of advanced technologies for application of protective coatings in Russian shipbuilding Olga FEDOROVA	128
Oral 53B	Electrochemical studies and numerical modelling of laser alloyed Al-Sn-Ti coating in saline environment Olawale FATOBA	129
Oral 54B	Electrochemical assessment of ammonium benzoate as corrosion Inhibitor of mild steel in 0.5M HCl solution: <i>Solanum tuberosum</i> extract as surfactant Olaitan AKANJI	130

POSTER SESSION

PT S1-1	Lanthanum and Yttrium rare earth based conversion to improve the 6061 & 2024 aluminum alloys protection Bekhiti DJILLALI	131
PT S1-2	Advanced ceramic coatings to prevent corrosion and fouling in offshore components David VÉLEZ	132
PT S1-3	Application of the conducting polymers in the marine anticorrosion paints Ahcene SAKHRI	133
PT S1-4	Study on the performance of different type epoxy resin coatings under hydrostatic pressure seawater environment Bin LIU	134
PT S1-5	Coatings for corrosion protection of Mg alloys Aurélie DUPUIS	135
PT S2-1	Dynamics of carbon steel corrosion in an estuarine Amazonian environment (MIC) Paule SALVIN	136
PT S2-2	Influence of <i>Desulfovibrio</i> sulphate reducing-bacteria in the corrosion of mild steel coated with self-healing coatings João TEDIM	137
PT S2-3	Electrochemical aspects of stainless steels corrosion in seawater Valery KARPOV	138
PT S3-1	Use and misuse of anodic protection in ballast tanks Kris DE BAERE	139
PT S3-2	SRB induced accelerated stress corrosion cracking under cathodic protection potential Jizhou DUAN	140
PT S3-3	The effect of fouling organisms on calcareous deposit of carbon steel Jie ZHANG	141
PT S4-1	“Marine Fouling Species from the Brazilian Coast” database: a web-based system for marine biosecurity management Ricardo COUTINHO	142
PT S4-2	At the border: assessing vessel biofouling risks in an operational context Daniel KLUZA	143
PT S4-3	Ship biofouling: what are the biosecurity risks? John A. LEWIS	144
PT S5-1	An impact of nautical tourism on copper concentrations in the Krka River estuary (Croatia) Cédric GARNIER	145

PT S5-2	Zinc governs the release rate of copper in a generic antifouling paint J. Fredrik LINDGREN	146
PT S6-1	Role of hydrodynamic condition on biofilm formation of <i>Bacillus</i> sp. in a rotating disk system Leila ABDOLI	147
PT S6-2	Deep sea biofouling - state of the art and where are we going? Nikoleta BELLOU	148
PT S6-3	Impacts of a multi-contamination gradient in a North-Western Mediterranean bay (Toulon Bay, France) on biofilm microbial communities analyzed by flow cytometry Clément COCLET	149
PT S6-4	LC-MS based metabolic profiling of marine bacterial strains demonstrates variation between free-living and biofilm lifestyles Laurie FAVRE	150
PT S6-5	The effects of long-term grooming on the diatom community structure and biofilm adhesion to ship hull coatings Kelli HUNSUCKER	151
PT S6-6	Antibacterial activity of green algal extracts against fouling bacteria isolated from bay of Carthage (northern coast of Tunisia) Leila KTARI	152
PT S6-7	A robust quorum quenching enzyme for antifouling applications Laure PLENER	153
PT S6-8	Biofouling, deposition and corrosion in cooling water cycles using brackish seawater Pauliina RAJALA	154
PT S6-9	Dynamic biofilm growth and collection using a strut arrangement on a catamaran vessel Serkan TURKMEN	155
PT S7-1	Extracellular polymeric substances from two marine biofilm forming strains, <i>Pseudoalteromonas ulvae</i> TC14 and <i>Shewanella</i> sp. TC11: Characterization of exopolysaccharides and antifouling activities Roberto ABBAMONDI	156
PT S7-2	Inhibition of bacterial quorum sensing by macroalgae: importance of associated microbial communities Sergey DOBRETsov	157
PT S7-3	Application of green fluorescent protein as a viable marker in a pioneer marine species, <i>Pseudoalteromonas</i> sp. D41 for adhesion and biofilm dynamics analysis Catherine DREANNO	158

PT S7-4	Hanging on by a thread: the ecomechanics of mussel byssus glue Matthew GEORGE	159
PT S7-5	Investigation of different marine bacterial strains behaviors in biofilm Richard GUILLONNEAU	160
PT S7-6	Biofilm formation and c-di-GMP signaling in marine bacteria Manar HARB	161
PT S7-7	Quorum Sensing" system characterization of <i>Shewanella woodyi</i> and its role in biofilm formation Mahmoud HAYEK	162
PT S7-8	Marine <i>Roseobacters'</i> lifestyles in biofilms forming conditions Raphaël LAMI	163
PT S7-9	Implication of extracellular components of <i>Shewanella frigidimarina</i> NCIMB400 membrane on adhesion and biofilm formation Aurore PUYPEGE	164
PT S8-1	Study of gene expression along the settlement process of barnacle <i>Balanus improvisus</i> Anna ABRAMOVA	165
PT S8-2	Fouling in finfish aquaculture: a case study from Adriatic sea Alessandra BELLUCCI	166
PT S8-3	A multivariate analysis of the attachment of biofouling organisms in response to surface properties Eric R. HOLM	167
PT S8-4	Investigating the <i>Amphibalanus improvisus</i> octopamine receptor – comparison between receptor binding, efficacy and physiological output Lena LINDBLAD	168
PT S8-5	Coastal marine fouling monitoring: validation of an innovative field exposure system and comparison between covering assessment methods Veronica PIAZZA	169
PT S8-6	Preparing samples of antifouling systems for successful testing in the marine environment Abraham STEPHENS	170
PT S8-7	The Seasonal variation of offshore macrofaunal fouling assemblages in the South China Sea Min TANG	171
PT S8-8	The primary study on the characteristics of biofouling community in the nearshore aquaculture in the South China Sea Chaochao WANG	172

PT S8-9	Varying mussel settlement responses to marine biofilms on polyurethane, epoxy resin and PDMS Jin-Long YANG	173
PT S8-10	Automatic Classification of the Settlement Behaviour of Barnacle Cyprids Ahmad ALSAAB	174
PT S9-1	Development of standard and novel laboratory methods to evaluate anti-macrofouling efficacy Robert BUNET	175
PT S9-2	Assessing the performance of low toxic cost efficient and environment friendly antifouling materials S��verine LARROZE	176
PT S9-3	Marine biofouling on flat panels with graded concentration of biocides Hans ELWING	177
PT S9-4	A TLC-agar method as an alternative to liquid-culture method for the evaluation of algaecidal activity Isabel FREIRE FONTANS	178
PT S9-5	Increased settlement rates of field-caught barnacle larvae in settlement assays adding metamorphosed juveniles Kristina GALL	179
PT S9-6	Early detection of bacterial biofilms in seawater lines: a powerful tool for preventing problems Francesca GARAVENTA	180
PT S9-7	The Mediterranean Sea urchin <i>Paracentrotus lividus</i> : an effective embryotoxicity model Eldad GUTNER-HOCH	181
PT S9-8	Characterisation of marine biofilms grown under different hydrodynamic regimes and their impact in ship operational efficiency Jack HAYDEN	182
PT S9-9	A flow-through method of laboratory testing for the efficacy of antifouling paints using three types of fouling organisms: barnacle, mussel and green algae Ichiro KATSUYAMA	183
PT S9-10	Development of bacteria and microalgae biofilm in photobioreactor to evaluate antifouling surfaces Tiffany LE NORCY	184
PT S9-11	Effect of cuprous oxide particules on the roughness boundary layer and drag characteristics of marine antifouling coatings Chang LI	185
PT S9-12	Combatting fouling on fish cages in three seas: towards protocol for long term static immersion tests Rachel MAILICK	186

PT S9-13	Development of a test platform for anti-fouling coatings Raf MESKENS	187
PT S9-14	Optimization of the screening method for anti-biofouling compounds using the xCELLigence® system Andrea MURAS	188
PT S9-15	Matching forces applied in underwater hull cleaning with adhesion strength of marine organisms Dinis OLIVEIRA	189
PT S9-16	Adhesive properties of three marine bacteria towards FRC-SPC hybrid antifouling coatings Aurore PUYMEGE	190
PT S9-17	3D printing of biofouling organisms for hydrodynamic testing sessions Scott STORMS	191
PT S9-18	Targeted in-field macro-fouling tests in Singapore Wensley Louis WIDJAJA	192
PT S9-19	The use of a simple x-ray fluorescence method (XRF) for quantification of Cu, Zn and Sn (TBT) content in marine coatings Erik YTREBERG	193
T S10-1	The impact of microbial biofouling on marine resource extraction: a case study involving uranium adsorbents George BONHEYO	194
PT S10-2	The impact of fouling control coating selection on hull roughness: an updated review Haoliang CHEN	195
PT S10-3	Advanced coatings for offshore renewable energy Hans ELWING	196
PT S10-4	Using three dimensional printing to investigate the hydrodynamic effect of biofouling (<i>Chirona Hameri</i>) in relation to tidal energy Rebecca FRANCIS	197
PT S10-5	Settlement of an alien mollusc in a mediterranean industrial plant: strategy for the optimization and management of antifouling treatments Francesca GARAVENTA	198
PT S10-6	In-service performance evaluation of low frictional AF marine coating based on ISO/DIS19030 Inwon LEE	199
PT S10-7	Review and assessment of mechanical methods for underwater cleaning of marine structures Tom MARQUARDT	200

PT S10-8	Similarity transform method to predict full scale ship performance based on various lab skin friction tests Hyun PARK	201
PT S10-9	Additive manufacturing for the control of biofouling in problematic vessel niche areas Richard PIOLA	202
PT S10-10	Assessment of fouling release coating degradation caused by grooming Melissa TRIBOU	203
PT S10-11	Investigation of the biofouling and corrosion performance of thermal spray coatings subjected to static immersion in Australian marine site Scott A. WADE	204
PT S10-12	Identification of variables that are significant to the rate of change in a ship's powering penalty J. Travis HUNSUCKER	205
PT S11-1	Antifouling properties of nature-inspired synthetic compounds Joana ALMEIDA	206
PT S11-2	Natural antifouling compounds: promising non-biocidal alternatives from cyanobacteria Joana ALMEIDA	207
PT S11-3	Cardiac glycosides and aglycones as potential green antifoulants Danqing FENG	208
PT S11-4	Algae against algae: microalgae as source of novel antifouling compounds Isabel FREIRE FONTANS	209
PT S11-5	Antifouling properties of the brown alga <i>Taonia atomaria</i> (Woodward) J. Agardh from Tunisian coasts: field experiments Leila KTARI	210
PT S11-6	Evaluation of bioactive properties of <i>Cystoseira foeniculacea</i> L. (Grev. Emend. Sauvageau) and <i>Halocnemum strobilaceum</i> (Pall.) Bieb 1819 extracts from Trapani saltworks (NW Sicily): antioxidant and antimicrofouling Concetta Maria MESSINA	211
PT S11-7	Exploiting the chemodiversity of tropical microalgae for the discovery of natural antifoulants through the BIOPAINTROP project Damien REVEILLON	212
PT S11-8	Antifouling potentials of marine macroalgae extracts from coasts of La Paz bay, Mexico Ilse SANCHEZ-LOZANO	213

PT S11-9	Bridging the gaps over a sea of biofouling – SP Technical Research Institute of Sweden aims to facilitate the antifouling innovation process for research groups Johan SVENSON	214
PT S11-10	Synthesis of α,α -disubstituted amino acid isocyanide derivatives and antifouling activity: structure–activity relationship studies Shuhei TAKASHIMA	215
PT S11-11	Seaweed mediated synthesis of Ag/Ti, Ag/Zn and Ti/Zn nanoparticles: Potent antifouling property V. Sri RAMKUMAR	216
PT S11-12	Tropical microalgae isolated on Reunion island (France, Indian Ocean) as sources of antifouling molecules: the BIOPAINTROP project Jean-François BRIAND	217
PT S12-1	Synthesis and antifouling properties of non-metal acrylic boron polymers for marine antifouling application Yakun LI	218
PT S12-2	New antifouling coating containing polymeric biocide polyhexamethylene guanidine molybdate Olena MOSHYNETS	219
PT S12-3	Diffusion of biocides in polymeric matrices: a tool for rational coating design Alexander PAPIEZ	220
PT S12-4	Grafting antifoulant groups into silicone based polyurethane: combination of antifouling and fouling release properties Qingyi XIE	221
PT S12-5	Contrasting biofouling in steam condenser: MATCHING Approach Rob ONDERWATER	222
PT S13-1	Self-structuring surfaces with polydimethylsiloxane-thiole-acrylate coatings Andreas BRINKMANN	223
PT S13-2	A new sensitive self-polishing coating Clément DEZANET	224
PT S13-3	Tethered liquid surfaces as high performance anti-fouling coatings Deniz DOGAN	225
PT S13-4	Development of novel test platform for textured antifouling surfaces Alan BARRETT	226
PT S13-5	Liquid adhesion test bench with reclining ramp Valentin GATE	227

PT S13-6	Phase separation mechanisms in polydimethylsiloxane copolymer containing UV-curable polyurethane coatings Simon RUTHMANN	228
PT S13-7	The use of the sea anemone <i>Aiptasiomorpha minuta</i> as a possible agent to control biofouling on oysters during culture Cyril Glenn Perez SATUITO	229

JOINT WORKSHOP

JW-1	Mussel adhesion test as a tool to assess new antifouling coating Jérôme DELROISSE	230
JW-2	Evaluation of the influence of innovative antifouling solutions on the environmental impact of maritime transportation Sophie DROPSIT	231
JW-3	Picking the winners: choosing the most promising candidate coatings from a diverse selection Andrew GUERIN	232
JW-4	Flow-based method for characterization of microfouling on marine surfaces Gunhild HAGESKAL	233
JW-5	Almost there! Or are we? Dan ISAKSSON	234
JW-6	Smallmatek – nanocontainers technology: a case study from academia to industry Roberto MARTINS	235
JW-7	From discovery to market: the valley of death in anti-fouling research Ana OTERO	236
JW-8	Performance of functionalized POSS derivatives applied to smart anti-fouling concepts Monika PILZ	237
JW-9	Improved surface properties of antifouling coatings by incorporation of carbon nanotubes Aikaterini-Flora TROMPETA	238
JW-10	Exposure assessment of biocides and contaminants from antifouling paints and ballast water treatment installations Bert van HATTUM	239
JW-11	The antifouling challenges for marine energy developers Cecilia ZAMBRANO	240

INDEX		241
--------------	--	-----